

REMARKS

The Examiner is thanked for her careful and very thorough Office Action. The Examiner is particularly thanked for the helpful suggestions regarding correction of the alleged informalities.

Claims 1-5 and 10-13 are allowed. Claims 6-9 and 14-18 have been rejected.

Note that the amendments to Claims 15 and 16 are intended to be purely formal amendments, and are believed not to change the scope of these claims. Please also note that the amendment Claim 14 is not intended to be substantive but is being amended for clarification purposes.

35 USC § 112 Rejections

With regard to Claims 6 and 15, the Examiner has suggested that it is unclear what is meant by the phrase irreversible movement of a valve. Applicants would like to direct the Examiner's attention to paragraph [0186] (page 44, lines 12-19) of the present application which states:

In the most preferred embodiment the valve cycles through an irreversible movement which includes both open and closed positions, e.g. from a first state (e.g. closed) to a second state (e.g. open) and on to a third (closed) state, at which point the valve is permanently closed. (This can be implemented mechanically by a sleeve valve in which fluid pressure from mud flow cooperates with an electrical actuator to move the valve through its states, but does not permit the valve to reverse its movement.)

With regard to Claim 14, Applicants respectfully submit that the downhole circuitry causes a change in the drilling fluid pressure by causing a

movement of a valve. The valve moves in response to the downhole circuitry. Therefore, the downhole circuitry does cause a change in the drilling fluid pressure.

The Examiner has also suggested that the phrase "fluid static pressure" is unclear. Applicants have amended Claim 14 to read "fluid long-time average pressure" instead of "fluid static pressure" for clarification purposes.

As all grounds for this rejection have been traversed and/or obviated, Applicants respectfully request withdrawal of this rejection.

Art Rejections

The art rejections are all respectfully traversed.

Review of the References

Scherbatskoy relates to using hydraulic shock waves for telemetering logging information while drilling is in process.

Randall et al. relates to the transformation of measurement while drilling data acquired during various time intervals into corresponding equal depth intervals. This patent does not appear to disclose or suggest signaling the surface of impending drill bit failure.

Zaleski et al. merely teaches an instrumented bit, and does not remotely suggest that sensors should be located anywhere except in the bit, or that sensors should not be located in the bit.

Claims 14-18 stand rejected under 35 USC Section 102(b) as anticipated by *Scherbatskoy*.

The claim language of Claim 14 is not met. Specifically, Claim 14 recites, "**using downhole circuitry to signal a change in downhole equipment condition by causing a reduction in drilling fluid long-time average pressure.**"

Scherbatskoy relates to using hydraulic shock waves for telemetering logging information while drilling is in process. *Scherbatskoy* utilizes a succession of shock waves to transmit large amounts of data. *Scherbatskoy*

explicitly states that it does not simply use a reduction in drilling fluid long-time average pressure to signal a change in downhole equipment condition. For example:

Rapid or almost instantaneous openings and closings of the valve have an important and far reaching influence on the performance of a telemetering system in a measuring while drilling operation. The pressure variations detected at the earth's surface in accordance with my invention (FIG. 2B) show no similarity whatever to the pressure variations obtained by means of a slow acting valve (FIG. 1B).¹

For the sake of emphasis I wish to repeat that in the prior art the opening of the valve produced a single event namely a decrease in pressure and the subsequent closing of the valve produced another single event--an increase (sic) in pressure. On the other hand in my invention the fast opening of the valve as in FIG. 2A produces two events: a rapid decrease and subsequent increase in pressure (negative pulse "M" as in FIG. 2B). This is in contrast to the case shown in FIG. 1A and FIG. 1B where an opening and a subsequent closing of the valve is required in order to produce a decrease and a subsequent increase in pressure. Furthermore, the fast closing of the valve as in FIG. 2A produces an increase and a subsequent decrease of the mud pressure (positive pulse "N" as in FIG. 2B). Such an increase and subsequent decrease in pressure does not occur in the arrangements suggested in the prior art. In my invention, there are two shock waves produced by a single operation of the valve. A wave form such as shown in FIG. 2B, which comprises both a negative and a positive pulse, will be referred to in this specification as a "valve wavelet". Pressure pulses associated

¹ Col. 4, ll. 60-67 (emphasis added by Applicants).

*with a valve wavelet have a onset rate of several thousand psi/sec. and are of short duration.*²

Therefore, as stated in the sections of *Scherbatskoy* cited above, signaling downhole conditions by simply causing a reduction in drilling fluid long-time average pressure is not the same as using hydraulic shock waves for telemetering logging information. Producing hydraulic shock waves involves more than simply reducing drilling fluid long-time average pressure. Therefore, a prima facie case of anticipation has not been established by the Examiner with regard to Claim 14.

The present application also expressly distinguishes between this art and the present inventions:

This type of transmission is different that standard mud-pulse technology which is used in MWD systems. The difference lies in the fact that static pump pressure levels are monitored rather than transient acoustic pressure pulses. This type of transmission will be much slower than mud-pulse telemetry systems, but is suitable for low tech, low cost settings where complex and expensive surface receivers are not economically practical.³

Finally, dependent Claims 15-18, which depend directly from independent Claim 14 and incorporate all the limitations thereof, also include additional limitations that are not shown or suggested by *Scherbatskoy*.

Specifically, amended Claim 15 now recites, **"The method of claim 14, wherein said reduction in drilling fluid long-time average pressure is caused by irreversible movement of a valve."**

² Col. 5, ll. 10-17 (emphasis added by Applicants).

³ Paragraph [0176] of the present application.

The Examiner has suggested that valve (40) of *Scherbatskoy* causes a reduction in drilling fluid static pressure by an irreversible movement. However, the movement of valve (40) is reversible:

The valve 40 can therefore be termed bistable; i.e., when "open" it tends to remain "open" and when "closed" it tends to remain "closed". Furthermore, when nearly open it tends to travel to the open condition and when nearly closed, it tends to travel to the closed condition. The valve 40 can therefore be "flipped" from one state to the other with relatively little energy. The valve action can be considered the mechanical equivalent of the electric bi-stable flip-flop well known in the electronics art.⁴

Therefore, a valve that can "flip-flop" cannot be said to be irreversible.

Specifically, amended Claim 16 now recites, **"The method of claim 14, wherein reduction in drilling fluid long-time average pressure is caused by cycling a valve through a position which reduces fluid pressure and through a position which restores fluid flow to its normal state."**

The Examiner has suggested that valve (40) of *Scherbatskoy* cycles through a position that reduces fluid pressure and through a position which restores fluid flow to its normal state. However, this is incorrect. *Scherbatskoy* clearly states that:

...in my invention the fast opening of the valve as in FIG. 2A produces two events: a rapid decrease and subsequent increase in pressure (negative pulse "M" as in FIG. 2B). This is in contrast to the case shown in FIG. 1A and FIG. 1B where an opening and a subsequent closing of the valve is required in order to produce a decrease and a subsequent increase in pressure.

⁴ Col. 12, ll. 36-45.

Therefore, it cannot be said that valve (40) of *Scherbatskoy* cycles through a position that reduces fluid pressure and through a position which restores fluid flow to its normal state when *Scherbatskoy* explicitly states that it does not.

Specifically, Claim 18 recites, "wherein said change in downhole equipment condition is determined by an adaptive filter which analyzes data from sensors located on the drill string."

As noted by the Examiner, *Scherbatskoy* does not disclose an adaptive filter that analyzes the data from sensors.

Thus, for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Claims 6-9 stand rejected under 35 USC Section 103(a) as being unpatentable over *Scherbatskoy* in view of *Zaleski et al.*

The asserted combination of references does not support each limitation of Claim 6. Specifically, Claim 6 recites, "by irreversible movement of a valve which affects mud flow impedance from a first state which is initially present during normal drilling irreversibly into at least one intermediate state having reduced mud flow impedance which indicates a failure condition, and thereafter irreversibly into a final state, which returns mud flow impedance to substantially that seen during normal drilling."

As stated earlier, *Scherbatskoy* explicitly states that its telemetry system requires more than this, and the "flip-flop" valve disclosed by *Scherbatskoy* cannot be said to be irreversible.

Also, dependent Claims 7-9 depend directly from allowable, independent Claim 6 and incorporate all the limitations thereof.

Thus, for this reason, and for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Claim 18 stands rejected under 35 USC Section 103(a) as being unpatentable over *Scherbatskoy* in view of *Randall et al.*

Dependent Claim 18 depends directly from allowable, independent Claim 14 and incorporates all the limitations thereof.

Thus, for this reason, and for the reasons discussed above, Applicant respectfully requests withdrawal of this rejection.

Conclusion

Thus, all grounds of rejection and/or objection are traversed or accommodated, and favorable reconsideration and allowance are respectfully requested. The Examiner is requested to telephone the undersigned attorney or Robert Groover for an interview to resolve any remaining issues.

Respectfully submitted,



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